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# TECHNICAL MEMORANDUM

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| TO: | Juan Somoano | REF. NO.: | 054046 |
| FROM: | Walter Pochron WSP Bruce Clegg/ko/14 BCC | DATE: | October 17, 2014 |
| RE: | **Pending Applications Surrounding Occidental Chemicals Remediation Site<br>OCC Facility<br>Wichita, Kansas** | | |

This memorandum is in response to a September 30, 2014 letter from the Kansas Department of Agriculture (KDA) to Mr. Brad Roberts of the U.S. EPA Region 7, regarding several pending groundwater appropriation applications (application, File Nos. 47,235, 47,513, 47,535, & 47,554). The KDA letter requested that additional information be provided to the KDA by October 30, 2014, demonstrating that the approval of the above-noted applications will have a negative impact on the public interest in regards to the groundwater contamination remediation efforts at the Occidental Chemical Corporation (OCC) site located in Sedgwick County, Kansas. As stated in Kansas Statues Annotated (KSA) 82a-711: *If a proposed use neither impairs a use under an existing water right nor prejudicially and unreasonably affects the public interest, the chief engineer shall approve all applications for such use made in good faith in proper form which contemplate the utilization of water for beneficial purpose.* The purpose of this memorandum is to evaluate information demonstrating that the above-noted applications may likely exacerbate previously documented groundwater contaminant migration in the vicinity of the former DeBruce Grain facility and OCC facilities.

In 2012, the approval of the above-noted applications was postponed by the KDA because the U.S. EPA informed the KDA of its concerns that allowing additional appropriation of groundwater in this area will negatively affect the ability to control the existing contaminant plume at the OCC site. Specifically the U.S. EPA indicated that allowing more groundwater pumping southeast and south of the OCC site could lead to further degradation of the groundwater quality.

**OCC Groundwater Remediation**

In 1971, organic contamination was identified by Vulcan Chemical, the predecessor chemical plant operator, in on-Site production wells. In 1972, two production wells and a monitoring well were converted to groundwater extraction wells to recover impacted groundwater. Since this time several groundwater investigations have been completed to determine the nature and extent of contamination.

In 1976, the Resource Conservation and Recovery Act (RCRA) was promulgated. Shortly thereafter, Vulcan Chemical implemented an interim corrective measure (ICM) to hydraulically contain impaired groundwater by placing three interceptor wells along the southern boundary of the closed hazardous waste landfill, one interceptor well along the southern boundary of the production area, and two interceptor wells along the eastern boundary of the closed hazardous waste landfill area. Two additional interceptor wells, were installed shortly thereafter along the southern

boundary of the Site towards the west. These interceptor wells provided a hydraulic barrier to limit the migration of contaminated groundwater.

OCC acquired the Vulcan Chemical Plant in 2005, and since that time OCC has conducted numerous investigations and enhancements to interim corrective measures pursuant to RCRA corrective action. The current groundwater ICM consists of 14 interceptor wells generally affecting shallow (>100 feet below ground surface [bgs]) groundwater flow conditions. These interceptor wells currently operate at a combined flow rate of approximately 600 gallons per minute to maintain cones of depression within shallow groundwater to prevent migration of contaminants.

**Groundwater Quality**

The effectiveness of the groundwater ICM is monitored by measuring groundwater analyte concentrations at approximately 140 monitoring wells and measuring water levels on a regular periodic basis. Figure 1 illustrates the extent of the well monitoring network located along the perimeter of detected chemistry within shallow groundwater in relation to the referenced appropriation application file numbers. As shown on this figure the extent of these contaminant plumes extend over an area of more than 2-square miles and is such that at least one of the proposed well locations (47,554) is within this perimeter. This location and 3 others (46,593, 47,235, and 47,513) are located between the plume and the existing City of Haysville water wells. In addition, numerous private water wells exist south of 71$^{st}$ street between the plume and three of the proposed well locations. This figure illustrates that regional pumping of agricultural and/or industrial wells in the area has already had an influence on the size and shape of these plumes over the past decades. Furthermore, additional pumping in these areas will increase groundwater flow through or towards the City of Haysville municipal wells and private water wells.

**KDHE Study**

In 2014, the Kansas Department of Health and Environment (KDHE) completed two groundwater investigations[1] at and near the former DeBruce Grain facility located at 5755 South Hoover Road in Wichita, Kansas. The investigations were conducted in a cooperative agreement with the U.S. EPA in response to information indicating a potential carbon tetrachloride source at the former DeBruce Grain facility. Figure 4 in the KDHE Site Inspection report illustrates carbon tetrachloride concentrations in the shallow groundwater using data from the KDHE investigations and OCC monitoring data. The results of the KDHE's investigation have confirmed a separate groundwater contamination source of carbon tetrachloride emanating from the DeBruce Grain facility. A copy of the KDHE's Site Investigation report is provided in Attachment A for your convenience.

The nature and extent of this newly identified carbon tetrachloride source area at the former DeBruce Grain facility has not been elucidated (beyond the scope of the KDHE investigations). Therefore further pumping in the area could further exacerbate migration of this source and the distal extent of related dissolved phase contaminants. Given the current uncertainty of the source area location, geometry and containment any new hydraulic influences should be avoided until a better understanding of this source is developed.

[1] Preliminary Assessment DeBruce Grain Site Wichita, Kansas, Prepared by the Kansas Department of Health and Environment Bureau of Environmental Remediation, May 2014.
Site Inspection DeBruce Grain Wichita, Kansas, Prepared by the Kansas Department of Health and Environment Bureau of Environmental Remediation, September 2014.

**Conclusion**

This memorandum provides the information requested by the KDA, demonstrating a potential negative impact on the public interest. Additional high volume pumping in the vicinity of the former DeBruce Grain or OCC facilities could undermine the containment provided from OCC's groundwater interceptor well network. In addition, approving additional appropriation of groundwater in this area will have unknown effects on the newly identified source of groundwater contamination associated with the former DeBruce Grain facility.

1" ≈ 1 mile

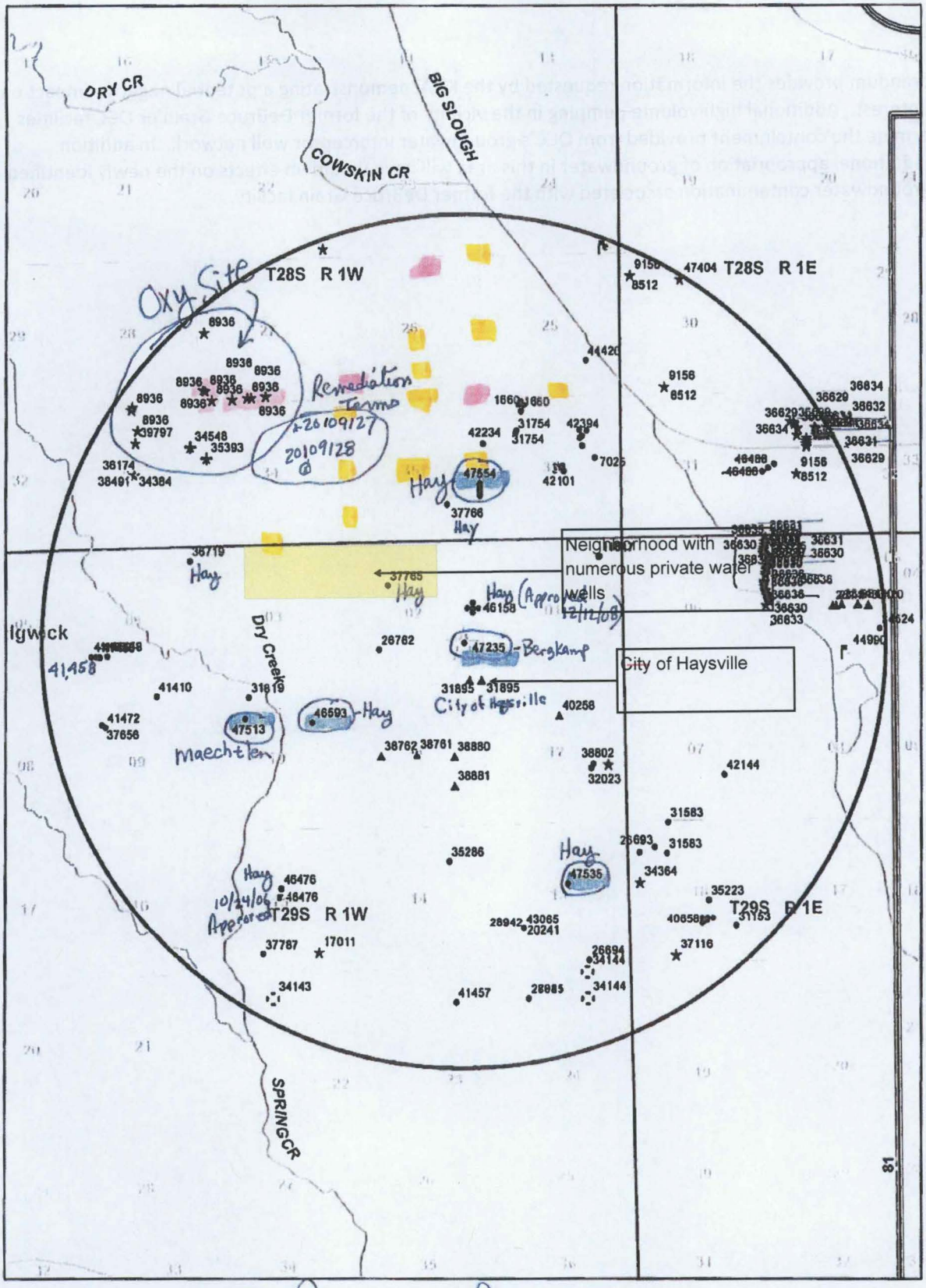


**Figure 1**

# Attachment A

**KDHE's Site Investigation Report**

Curtis State Office Building
1000 SW Jackson, Suite 410
Topeka, Kansas 66612-1367

Kansas Department of Health and Environment

# Site Inspection

**DeBruce Grain**
**Wichita, Kansas**

Bureau of Environmental Remediation

**Our Mission: To protect and improve the health and environment of all Kansans**

**Site Inspection**

# DeBruce Grain

**Wichita, Kansas**

**Prepared by:**
**Kansas Department of Health and Environment**
**Bureau of Environmental Remediation**
**Remedial Section**
**Site Assessment Program**

**September 2014**

**State ID: C2-087-73093**
**EPA ID: KSN000706409**

**Project Manager:** Nicholas Schneider, Environmental Scientist II

**Field Team Members:**
Farrell Dallen, Environmental Scientist II
John Jones, Environmental Scientist II

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# 1.0 Introduction

This document presents the findings of a Site Inspection (SI) conducted by the Kansas Department of Health and Environment (KDHE) at the DeBruce Grain site in Wichita, Kansas. The assessment was conducted as part of continuing cooperative agreement with the United States Environmental Protection Agency (EPA) to perform investigations of selected sites to evaluate potential or actual releases of hazardous substances, pollutants, or contaminants in Kansas. These investigations are performed under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR § 300.400-300.425.

This SI was initiated by KDHE's Bureau of Environmental Remediation in response to the discovery of tetrachloromethane (carbon tetrachloride) in industrial wells for Westar Energy's Murray Gill Energy Center. The purpose of this SI is to determine the source of contaminants, collect sufficient information to assess the threat posed to human health and the environment, and to determine the need for further action under CERCLA/SARA consistent with the NCP. The investigation included review of historical information, collection of groundwater samples, evaluation of the site using the Hazard Ranking System (HRS) guidance, and compilation of a comprehensive target survey. The DeBruce Grain site has the EPA ID #KSN000706409.

# 2.0 Site Information

## 2.1 Site Location and Description

The former DeBruce Grain facility is located at 5755 South Hoover Road in Wichita, Sedgwick County, Kansas. The facility is currently owned and operated by Gavilon Grain and consists of an 18 million bushel concrete grain elevator, a lean-to grain storage building along the southeastern edge of the elevator, eight stand-alone warehouses, and an office building. The facility is surrounded by Westar Energy's Murray Gill Energy Center to the north, residences and cropland to the east, cropland to the south, Occidental Chemical Corporation and Atofina Chemicals to the southwest, and a railroad and cropland to the west. The public land survey description for the site is Sections 22 and 27 of Township 28 South and Range 1 West. The ground surface is generally level other than surface water drainage ditches along roadsides and the railroad.

## 2.2 Site Background

The grain elevator was constructed between 1953 and 1955 for the Garvey Grain Company. The facility was sold to DeBruce Grain, Inc., in 1996 and then to Gavilon Grain, LLC, in 2010. An explosion occurred at the facility in 1998 and destroyed several of the concrete silos, the head house, and the gallery above the northern silos. In response, the EPA initiated a responsible party emergency removal action and the site was placed in CERCLIS as the DeBruce Grain Elevator Explosion site, identification number

KSN000706409 (Reference 1). A 1972 KDHE Source Emission Report from Garvey Grain, Inc., indicated the facility used ten cases of phostoxin (aluminum phosphide) and nine thousand gallons of liquid 80-20 (80% carbon tetrachloride and 20% carbon disulfide) annually for grain fumigation (Reference 2).

The adjacent Occidental Chemical Corporation facility was constructed in 1951 by the Frontier Chemical Company. The Frontier Chemical Company merged with Follansbee Steel Corporation to become the Union Chemical and Material Corporation. The Union Chemical and Material Corporation was subsequently sold to the Vulcan Materials Company, then sold to Basic Chemicals, and finally sold to the Occidental Chemical Corporation. The facility produced various chemicals including chloroform and carbon tetrachloride. From the 1970s to present, numerous environmental investigations have been conducted. The EPA identifies the facility as Basic Chemicals #J07 (EPA Facility ID 110017424312). Environmental reports provided to EPA by the Occidental Chemical Corporation have documented widespread groundwater impacts of volatile organic compounds (VOCs) including carbon tetrachloride and chloroform, semi-volatile organic compounds, herbicides, and chloride. The groundwater contamination at the Occidental Chemical Corporation facility is being addressed through the Resource Conservation and Recovery Act (RCRA) Corrective Action Program under EPA oversight (Reference 3).

The adjacent Racon/Atofina/Arkema property operated a fluorocarbon manufacturing plant from 1965 to 2002. The facility produced refrigerants including trichlorofluoromethane (R-11), dichlorodifluoromethane (R-12), and chlorodiflouromethane (R-22). Numerous chemicals were used in the production of refrigerants including chloroform and carbon tetrachloride. In 2002 the property entered into the KDHE Voluntary Cleanup and Property Redevelopment Program. Several investigations have been conducted and results indicate widespread VOC contamination in soil and groundwater including groundwater impacts of carbon tetrachloride and chloroform (Reference 4).

The Westar Energy, Inc., Murray Gill Energy Center, located approximately 0.5 mile north of the site, began operation in 1954. The power plant is a 317-megawatt natural gas and oil fired power plant.

KDHE conducted a Preliminary Assessment at the grain elevator property in 2014 to determine if the facility was an additional source of carbon tetrachloride contamination in groundwater. Groundwater samples were collected from 34 and 52 feet in depth from six locations on the west/upgradient side of the elevator and nine locations on the east/downgradient side. The maximum detection of carbon tetrachloride on the upgradient side was 3,700 micrograms per liter (µg/L) while the maximum detection on the downgradient side was 19,000 µg/L. The shallow interval had only trace or no detections in all samples except the two samples nearest to and downgradient of the head house for the elevator. Both shallow and deep samples at the nearest sample to the head house indicated carbon tetrachloride at 15,000 µg/L. The grain elevator was determined to be an additional source of carbon tetrachloride contamination in groundwater (Reference 2).

This SI was initiated to investigate detections of carbon tetrachloride in industrial wells for the Murray Gill Energy Center. The EPA has established a network of monitoring wells surrounding the Occidental Chemical, Atofina, and Gavilon Grain facilities, which they

monitor yearly. During the sampling events, the eight original industrial wells for the Murray Gill Energy Center have also been sampled. Three of the wells indicated carbon tetrachloride at 27 µg/L, 1 µg/L, and 0.5 µg/L during the 2013 sampling event. The impacted wells are 0.3, 1.4, and 0.9 miles north-northwest of the grain elevator, respectively.

### 2.3 Hazardous Substance Characteristics

Carbon tetrachloride has been utilized as a grain fumigant, in fire extinguishers, in the production of refrigeration fluid and propellants for aerosol cans, as a cleaning fluid and degreasing agent, and in spot removers. However, it is currently banned for these uses and is only used in limited industrial processes. Carbon tetrachloride does not occur naturally and does not dissolve easily in water. It is a clear liquid with a sweet smell and volatilizes quickly into a gas. High exposures can cause liver, kidney, and central nervous system damage. Very high exposures can lead to headaches, dizziness, sleepiness, nausea, and vomiting, and in severe cases coma and death. Carbon tetrachloride is reasonably assumed to be a carcinogen (Reference 5).

## 3.0 Assessment Activities

### 3.1 Groundwater Sample Collection

KDHE personnel collected groundwater samples from domestic wells on July 29 and August 4, 2014, and from direct-push locations on August 11 and 12, 2014. A total of ten domestic well samples were collected, including nine drinking water wells and one pond-filling well. The direct-push samples were collected using a Geoprobe. Samples were collected from two depths in nine locations.

Each domestic well was sampled using an outside spigot except the Mark Bergkamp well, which was sampled using a kabis sampler. The spigot was turned on and allowed to purge for two to three minutes before slowing the flow and filling two acidified 40-milliliter (mL) vials. The Mark Bergkamp residence was under construction and the well had not yet been fitted with a pump. An unacidified 40-mL vial was attached to the kabis sampler and lowered to the bottom of the well using nylon string. The sampler was retrieved and the vial was removed and topped off with water left in the sampler. The process was repeated for a second vial. All vials were sealed headspace-free and placed into an iced cooler immediately following collection.

KDHE personnel utilized a Model 6600 Geoprobe for the direct-push locations along South 55$^{th}$ Street and South Ridge Road. The samples were collected on the shoulder of the road, in the ditch if accessible, or on driveways over culverts. A screened sampler was advanced to 78 or 79 feet below ground surface (bgs) before the screen was released. A stainless steel check valve was attached to polyethylene tubing and lowered down the center of the probe rods and into the sampler. One liter of groundwater was purged prior to pinching off and retrieving the tubing. The check valve was removed and a sample was gravity-fed into two acidified 40-mL vials. These samples are labeled with a "D" at the

end of the sample identification number. The screened sampler was then raised to a total depth between 53 and 60 feet bgs. A clean check valve was attached to new polyethylene tubing and lowered down the probe rods. One liter of groundwater was purged prior to retrieving the tubing. The sample was gravity-fed from the bottom of the tubing into two acidified 40-mL vials. These samples are labeled with an "S" at the end of the sample identification number. All samples were placed into an iced cooler immediately following collection.

Following the collection of the shallow groundwater sample, the probe rods were removed and the resulting hole was filled and plugged with granular bentonite.

All samples were submitted to the Kansas Health and Environmental Laboratories for VOC analysis by EPA Method 8260.

### 3.2 Soil Sample Collection

There were no soil samples collected during this SI.

### 3.3 Analytical Results

Analytical results for groundwater samples are compared to the EPA's Maximum Contaminant Levels (MCL) where available (Reference 6). VOCs without an established MCL were compared to KDHE's residential Tier 2 Risk-based Standards for Kansas (RSK) levels (Reference 7).

Carbon tetrachloride was detected in sample D-1S at 0.6 µg/L, D-1D at 6.7 µg/L, D-2D at 3.7 µg/L, D-22 at 3.4 µg/L. The concentration of carbon tetrachloride in sample D-1D exceeds the MCL of 5 µg/L. Chloroform was detected in D-1S at 1.3 µg/L, D-1D at 7.6 µg/L, D-2D at 3.7 µg/L, D-22 at 3.8 µg/L, and D-3D at 2.9 µg/L. All detections of chloroform were below its MCL of 80 µg/L. Chloromethane was detected in D-7S at 0.74 µg/L, below its RSK of 127 µg/L. Tetrachloroethylene (PCE) was detected in D-1D at 1.4 µg/L and D-2D at 0.54 µg/L, below its MCL of 5 µg/L. Trichloroethylene (TCE) was detected in D-1D at 2.1 µg/L and D-22 at 0.51 µg/L. Bromoform and toluene were detected in trace concentrations in one and three samples, respectively.

There were no detections of any VOCs in any domestic well.

### 3.4 Quality Assurance Procedures

A Quality Assurance Project Plan (QAPP) was developed for the site by completing a site-specific addendum to the Site Assessment Program's generic QAPP. All samples were collected in accordance with appropriate standard operating procedures. Duplicate groundwater samples were collected from D-2D (D-22), D-4S (D-42), and D-8D (D-82). Concentrations of carbon tetrachloride and chloroform were within 10% of the original D-2D sample in duplicate D-22. PCE was detected in D-2D but not in the duplicate and TCE was detected in D-22 but not in the original. However, the detections were within 10% of the laboratory reporting limit so the levels may actually be comparable but not above the

reporting limit. Bromoform was detected in D-42 at 0.61 µg/L but not detected at the 0.5 µg/L laboratory reporting limit. Toluene was detected in both D-8D and D-82.

# 4.0 Groundwater Pathway

## 4.1 Site Geology

The site area around the Gavilon Grain facility and the Murray Gill Energy Center is broken up into many different soil classifications. Approximately 36 percent is the Vanoss silt loam, 17 percent is the Nalim loam, 15 percent is the Tabler silty clay loam, 13 percent is the Blanket silt loam, 11 percent is the Elandco silt loam, and the remaining 8 percent is split between Shellaberger sandy loam, Milan loam, and Waurika silt loam. These soils all form on paleoterraces or flood plains from alluvial parent material. The majority of the soil material is loam made of silt, silty clay, and sand (Reference 8).

Subsurface sediments include loess and alluvial terrace deposits of Pleistocene Age. Well logs from monitoring wells in the area generally indicate sand and gravel from 10 to 35 feet, clay or sandy clay between 35 and 45 feet, sand and gravel between 45 and 55 feet, sandy clay between 55 and 70 feet, sand and gravel between 70 and 85 feet, clay between 80 and 95 feet, and sand and gravel between 95 feet and bedrock around 100 feet.

Bedrock is the Permian-aged Wellington Formation. The Wellington Formation is part of the Sumner Group and consists mainly of shale. Additional smaller units include limestone, gypsum, and anhydrite (Reference 9).

Groundwater is generally found at approximately 35 feet in depth near the Gavilon Grain facility but is found closer at approximately 55 feet in depth west of the Murray Gill Energy Center due to an increase in ground surface elevation. Groundwater generally moves toward the southeast in the region. However, the wells for the Murray Gill Energy Center have capacities of 1,000 gallons per minute and may affect groundwater flow patterns when activated.

## 4.2 Groundwater Targets

The groundwater exposure pathway under the HRS is evaluated in part by calculating the number of residents, students, and workers served by water wells located within four miles of the site and determining whether these people are actually or potentially exposed to hazardous substances (Reference 10).

The Kansas Geological Survey WWC-5 database indicates 394 domestic wells within a four-mile radius of the site (Reference 11). There are 2.55 persons per household in Sedgwick County, which equates to 1,005 potential drinking water targets associated with domestic wells (Reference 12). At least eight domestic wells within two miles east and southeast of the site have been taken out of service and a City water supply line has been routed to the houses. Those wells have had detections of carbon tetrachloride above the MCL. However, one residence two miles south-southeast of the Gavilon Grain facility still

uses its domestic well and had a detection of carbon tetrachloride at 0.5 µg/L during a 2014 sampling event by Occidental Chemical. The eight domestic wells taken offline are considered Level I targets and the domestic well still online but with a concentration of carbon tetrachloride below the MCL is considered a Level II target. When multiplied by the average number of persons per household in the County, there are 21 Level I and 3 Level II targets associated with domestic wells.

The KDHE Bureau of Water database indicates there are ten active Public Water Supply (PWS) wells located within four miles of the site. Air Products and Chemicals has two non-transient and non-community water supply wells (15 and 303) located one to two miles southwest serving an estimated population of 60. The Occidental Chemical Corporation has three non-transient and non-community water supply wells (09, 10, and 11) located two to three miles north-northwest serving an estimated population of 285. Dusti's Place LLC has one transient and non-community water supply well (01) located three to four miles north-northwest serving an estimated population of 65. The City of Haysville has two community water supply wells (05 and 06) located three to four miles southeast serving an estimated population of 10,951 (Reference 14). The City of Haysville has five PWS wells. Multiplying the percentage of PWS wells within the target distance limit by the population served gives a total of 4,381 potential targets associated with the Haysville PWS wells (Reference 13).

### 4.3 Groundwater Pathway Conclusions

A release of hazardous substances to groundwater has been documented at the site. The groundwater pathway appears to pose the most significant threat to public health. Carbon tetrachloride was detected above the MCL in a groundwater sample collected along 47$^{th}$ Street South between the Gavilon Grain facility and the Murray Gill Energy Center. Two other samples indicated carbon tetrachloride below the MCL and three samples indicated chloroform, a breakdown product of carbon tetrachloride, under its MCL. PCE and TCE were also detected at low levels in two samples each.

Eight domestic wells have been taken out of service and replaced by a direct line to the City of Wichita's public water supply due to carbon tetrachloride contamination above the MCL. There are 21 Level I, 3 Level II, and a combined 5,796 potential drinking water targets under HRS that were identified for the SI.

## 5.0 Surface Water Pathway

### 5.1 Hydrologic Settings

Surface water flows over land and in roadside ditches generally toward the east until emptying into Cowskin Creek one mile to the east. Cowskin Creek drains into the Wichita Valley Center Floodway 1.5 miles east of the site, which drains into the Arkansas River 9 miles east-southeast of the site. The average annual precipitation in Wichita is 30 inches (Reference 14).

### 5.2 Surface Water Targets

The surface water exposure pathway under HRS is evaluated in part by calculating the number of residents, students, and workers served by surface water intakes located within 15 miles downstream of the site and whether these people are actually or potentially exposed to hazardous substances. No surface water intakes for drinking water are known to exist within 15 miles downstream of the site.

### 5.3 Surface Water Pathway Conclusions

No surface water samples were collected during this SI. Given the distance to a perennial surface water feature and the fact that groundwater moves towards the southeast, a release to surface water appears unlikely.

## 6.0 Soil Exposure and Air Pathways

### 6.1 Physical Conditions

The site contains a large grain storage facility with active rail lines along its western edge and an active natural gas electricity generation station. The ground surface is a mix of buildings, agricultural land, grass, and paved areas.

### 6.2 Soil Exposure and Air Pathway Targets

The soil exposure pathway under HRS assesses the risks associated with existing surficial contamination (0-2 feet bgs) at properties on which people live or work. No soil samples were collected during this SI. The likely source areas for the carbon tetrachloride contamination are covered by buildings, concrete, or rail lines. An estimated 50 people work within the vicinity of the contamination source and an estimated 5,000 people live within a four-mile radius of the site.

### 6.3 Soil Exposure and Air Pathway Conclusions

The HRS soil exposure and air pathways do not currently appear to pose a threat of exposure or potential exposure at the site (the air pathway of HRS addresses outside air only). Indoor air contamination via vapor intrusion may be an issue within the Gavilon Grain facility buildings but does not appear to pose a risk to downgradient structures due to the depth of the contamination and the layer of relatively uncontaminated groundwater above the deeper interval. An observed release of carbon tetrachloride to surface soil has not been documented at the site.

## 7.0 Summary and Conclusions

The former DeBruce Grain elevator is surrounded by Westar Energy's Murray Gill Energy Center to the north and Atofina Chemical and Occidental Chemical to the southwest.

Atofina Chemical is being addressed by KDHE's Voluntary Cleanup Program for soil and groundwater contamination by carbon tetrachloride, chloroform, PCE, TCE, and other VOCs. Occidental Chemical is being addressed by the EPA for soil and groundwater contamination by carbon tetrachloride, chloroform, PCE, TCE, and other VOCs. During an annual sampling event by Occidental Chemical, carbon tetrachloride was detected at 27 µg/L in the Westar Energy industrial well DW-4, 1 µg/L in industrial well DW-6, and 0.5 µg/L in industrial well DW-11.

The objective of this SI was to determine the source of carbon tetrachloride in the Murray Gill Energy Center industrial wells. Two possible scenarios involved a source northwest and upgradient of the industrial wells or a reversal of groundwater flow to the north-northwest due to industrial well pumping that drew contamination from the grain elevator and chemical plants. The first scenario was tested by sampling domestic wells northwest and west of the Murray Gill Energy Center and a line of direct-push sampling locations along Ridge Road between 47$^{th}$ and 55$^{th}$ Streets South. The second scenario was tested by a line of direct-push sampling locations along 55$^{th}$ Street South between the grain elevator and power plant. All domestic wells and direct-push locations along Ridge Road were non-detect for carbon tetrachloride and chloroform. However, direct-push locations along 55$^{th}$ Street South had detections of carbon tetrachloride, chloroform, PCE, and TCE. One detection of carbon tetrachloride exceeds the MCL. This appears to implicate a reversal of groundwater flow and the drawing of contaminants north by heavy pumping of the Murray Gill Energy Center industrial wells.

The Atofina Chemical site is currently being addressed through KDHE's Voluntary Cleanup and Property Redevelopment Program. The Occidental Chemical facility is being addressed through the RCRA Corrective Action Program under EPA oversight. The Gavilon Grain facility will be encouraged to participate in a KDHE cleanup program. No further Site Assessment consistent with the NCP is necessary if Gavilon Grain participates in a State program to address the DeBruce Grain site.

# 8.0 References


1) Environmental Protection Agency. DeBruce Grain Elevator Explosion, facility ID# KSN0000706409.

2) Kansas Department of Health and Environment, Division of Environment, Bureau of Environmental Remediation Files. DeBruce Grain site file, ID# C2-087-73093.

3) Environmental Protection Agency. Basic Chemicals #J07 site file, facility ID# 110017424312.

4) Kansas Department of Health and Environment, Division of Environment, Bureau of Environmental Remediation Files. Atofina Chemicals, Inc., site file, ID# C2-087-71694.

5) Agency for Toxic Substances and Disease Registry. Accessed September 3, 2014, from http://www.atsdr.cdc.gov/.

6) Environmental Protection Agency, National Primary Drinking Water Regulations. Maximum Contaminant Levels. Accessed September 3, 2014, from http://water.epa.gov/drink/contaminants/index.cfm#List.

7) Kansas Department of Health and Environment, Division of Environment, Bureau of Environmental Remediation. *Risk-Based Standards for Kansas RSK Manual-5th Version.* October 2010.

8) United States Department of Agriculture, National Resource Conservation Service. Web Soil Survey. 2011. Accessed September 4, 2014, from http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

9) Lane, Charles W. and Miller, Don E. *Geohydrology of Sedgwick County, Kansas.* 1965. Kansas Geological Survey Bulletin #176. Accessed September 4, 2014, from http://www.kgs.ku.edu/General/Geology/Sedgwick/index.html.

10) United States Environmental Protection Agency. *The Hazard Ranking System Guidance Manual, Publication 9345.1-07.* November 1992.

11) Kansas Geological Survey, water well completion records, form WWC-5. Accessed September 4, 2014, from http://www.kgs.ku.edu/Magellan/WaterWell/index.html.

12) United States Census Bureau. (2014). *Sedgwick County Quickfacts from the U.S. Census Bureau.* Accessed September 4, 2014, from http://quickfacts.census.gov/qfd/states/20/20173.html.

13) Kansas Department of Health and Environment, Division of Environment, Bureau of Water Public Water Supply Application, Drinking Water Watch Database for Sedgwick County.

14) Citytowninfo.com. Wichita, Kansas. Accessed September 4, 2014, from http://www.citytowninfo.com/places/kansas/wichita.